

12-5 The Normal Distribution

What You'll Learn

Scan the text in Lesson 12-5. Write two facts you learned about the normal distribution as you scanned the text.

1. _____

2. _____

Active Vocabulary

New Vocabulary Label each diagram with all terms listed at the left that apply.

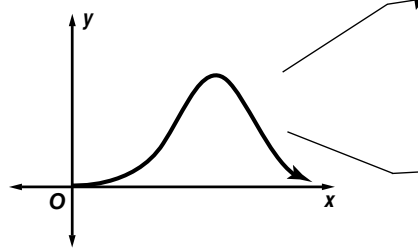
continuous probability distribution ▶

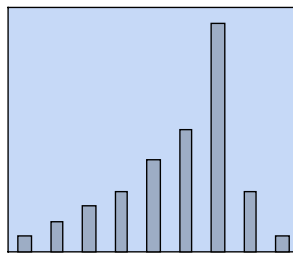
normal distribution ▶

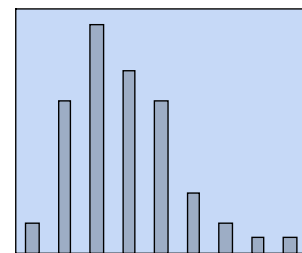
skewed distribution ▶

positively skewed distribution ▶

negatively skewed distribution ▶

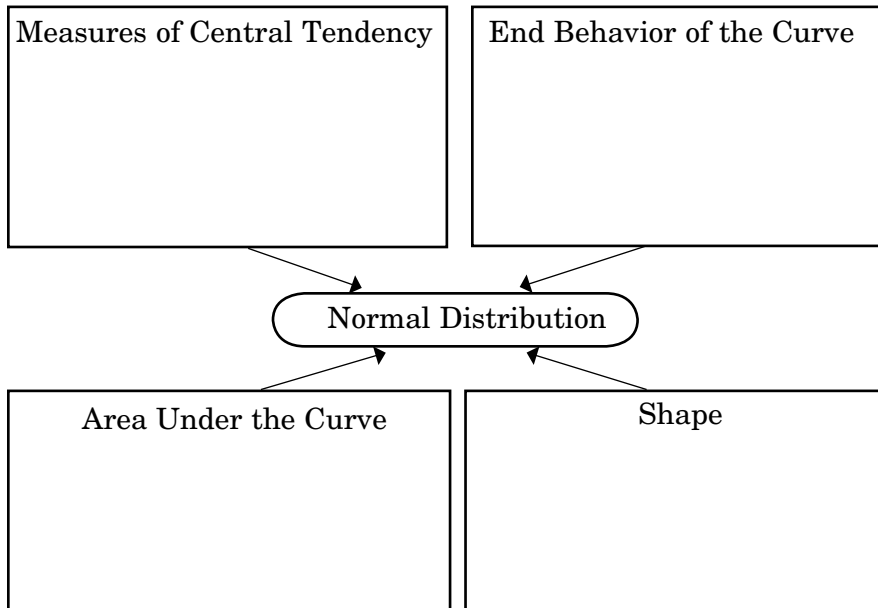






Lesson 12-5 *(continued)***Main Idea****Details****Normal and Skewed Distributions**

pp. 773–774

Describe the characteristics of a normal distribution in your own words.**The Empirical Rule**

pp. 774–775

The amount of weekly allowance of 1500 high school juniors is normally distributed with a mean of \$30 and a standard deviation of \$6. About how many students receive an allowance greater than \$42 per week?

How many standard deviations above the mean is \$42?	What percentage of students can be found in this area of the curve?	What is the number of students in this area of the curve?
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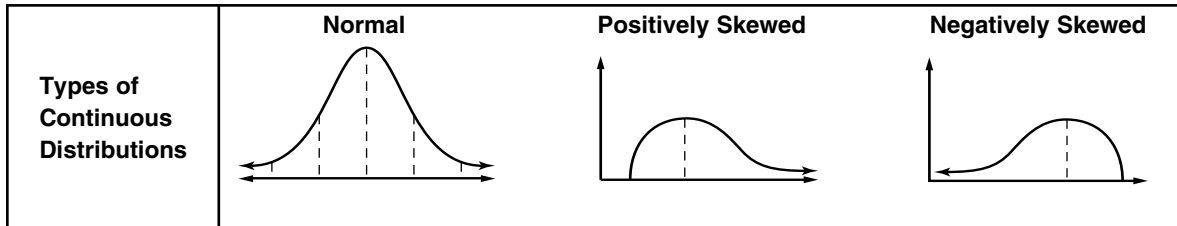
Helping You Remember

Many students have trouble remembering how to determine if a curve represents a distribution that is positively skewed or negatively skewed. What is an easy way to remember this?

12-5 Study Guide and Intervention

The Normal Distribution

Normal and Skewed Distributions A continuous probability distribution is represented by a curve.



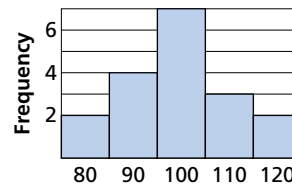
Example

Determine whether the data below appear to be *positively skewed*, *negatively skewed*, or *normally distributed*.

{100, 120, 110, 100, 110, 80, 100, 90, 100, 120, 100, 90, 110, 100, 90, 80, 100, 90}

Make a frequency table for the data.

Value	80	90	100	110	120
Frequency	2	4	7	3	2



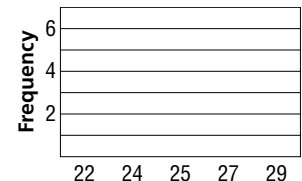
Then use the data to make a histogram.

Since the histogram is roughly symmetric, the data appear to be normally distributed.

Exercises

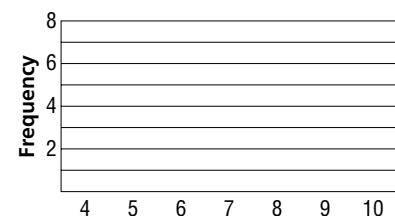
Determine whether the data appear to be *positively skewed*, *negatively skewed*, or *normally distributed*. Make a histogram of the data.

1. {27, 24, 29, 25, 27, 22, 24, 25, 29, 24, 25, 22, 27, 24, 22, 25, 24, 22}



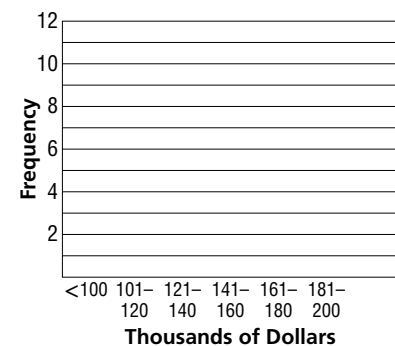
- 2.

Shoe Size	4	5	6	7	8	9	10
No. of Students	1	2	4	8	5	1	2



- 3.

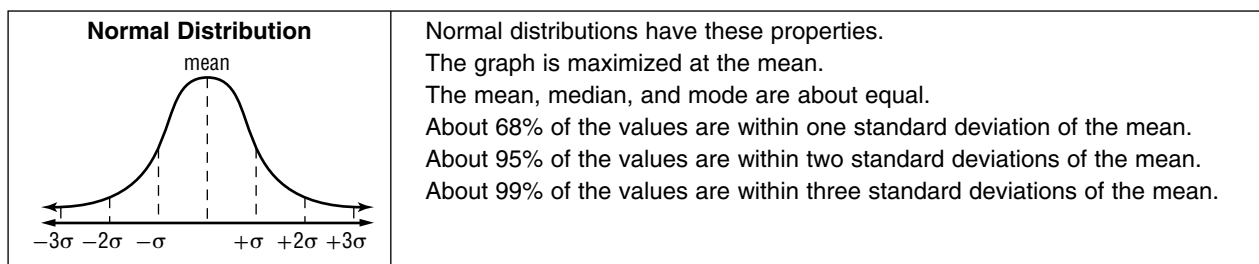
Housing Price	No. of Houses Sold
less than \$100,000	0
\$100,00–\$120,000	1
\$121,00–\$140,000	3
\$141,00–\$160,000	7
\$161,00–\$180,000	8
\$181,00–\$200,000	6
over \$200,000	12



12-5 Study Guide and Intervention *(continued)*

The Normal Distribution

The Empirical Rule



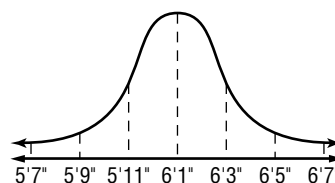
Example

The heights of players in a basketball league are normally distributed with a mean of 6 feet 1 inch and a standard deviation of 2 inches.

- a. What is the probability that a player selected at random will be shorter than 5 feet 9 inches?

Draw a normal curve. Label the mean and the mean plus or minus multiples of the standard deviation.

The value of 5 feet 9 inches is 2 standard deviations below the mean, so approximately 2.5% of the players will be shorter than 5 feet 9 inches.



- b. If there are 240 players in the league, about how many players are taller than 6 feet 3 inches?

The value of 6 feet 3 inches is one standard deviation above the mean. Approximately 16% of the players will be taller than this height.

$$240 \times 0.16 \approx 38$$

About 38 of the players are taller than 6 feet 3 inches.

Exercises

- EGG PRODUCTION** The number of eggs laid per year by a particular breed of chicken is normally distributed with a mean of 225 and a standard deviation of 10 eggs.
 - About what percent of the chickens will lay between 215 and 235 eggs per year?
 - In a flock of 400 chickens, about how many would you expect to lay more than 245 eggs per year?
- MANUFACTURING** The diameter of bolts produced by a manufacturing plant is normally distributed with a mean of 18 mm and a standard deviation of 0.2 mm.
 - What percent of bolts coming off of the assembly line have a diameter greater than 18.4 mm?
 - What percent have a diameter between 17.8 and 18.2 mm?

12-5 Skills Practice**The Normal Distribution**

Determine whether the data appear to be *positively skewed*, *negatively skewed*, or *normally distributed*.

1.

Miles Run	Track Team Members
0–4	3
5–9	4
10–14	7
15–19	5
20–23	2

2.

Speeches Given	Political Candidates
0–5	1
6–11	2
12–17	3
18–23	8
24–29	8

3. **PATIENTS** The frequency table to the right shows the average number of days patients spent on the surgical ward of a hospital last year.

a. What percentage of the patients stayed between 4 and 7 days?

b. Does the data appear to be *positively skewed*, *negatively skewed*, or *normally distributed*? Explain.

Days	Number of Patients
0–3	5
4–7	18
8–11	11
12–15	9
16+	6

4. **DELIVERY** The time it takes a bicycle courier to deliver a parcel to his farthest customer is normally distributed with a mean of 40 minutes and a standard deviation of 4 minutes.

a. About what percent of the courier's trips to this customer take between 36 and 44 minutes?

b. About what percent of the courier's trips to this customer take between 40 and 48 minutes?

c. About what percent of the courier's trips to this customer take less than 32 minutes?

5. **TESTING** The average time it takes sophomores to complete a math test is normally distributed with a mean of 63.3 minutes and a standard deviation of 12.3 minutes.

a. About what percent of the sophomores take more than 75.6 minutes to complete the test?

b. About what percent of the sophomores take between 51 and 63.3 minutes?

c. About what percent of the sophomores take less than 63.3 minutes to complete the test?

12-5 Practice**The Normal Distribution**

Determine whether the data appear to be *positively skewed*, *negatively skewed*, or *normally distributed*.

1. **Time Spent at a Museum Exhibit**

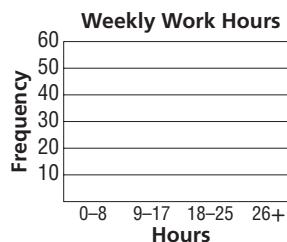
Minutes	Frequency
0–25	27
26–50	46
51–75	89
75–100	57
1001	24

2. **Average Age of High School Principals**

Age in Years	Number
31–35	3
36–40	8
41–45	15
46–50	32
51–55	40
56–60	38
60+	4

3. **STUDENTS** The frequency table to the right shows the number of hours worked per week by 100 high school students.

- What percentage of the students worked between 9 and 17 days?
- Do the data appear to be *positively skewed*, *negatively skewed*, or *normally distributed*? Explain.



Hours	Number of Students
0–8	30
9–17	45
18–25	20
26+	5

4. **TESTING** The scores on a test administered to prospective employees are normally distributed with a mean of 100 and a standard deviation of 15.

- About what percent of the scores are between 70 and 130?
- About what percent of the scores are between 85 and 130?
- About what percent of the scores are over 115?
- About what percent of the scores are lower than 85 or higher than 115?
- If 80 people take the test, how many would you expect to score higher than 130?
- If 75 people take the test, how many would you expect to score lower than 85?

5. **TEMPERATURE** The daily July surface temperature of a lake at a resort has a mean of 82° and a standard deviation of 4.2° . If you prefer to swim when the temperature is at least 77.8° , about what percent of the days does the temperature meet your preference?